

prevailed, and the entire month was favorable for the filling and ripening of grain and the growth of late crops, such as corn, potatoes, hops, and fruit.—*Edward A. Beals, Forecast Official.*

HAVANA, CUBA, FORECAST DISTRICT.

The only important disturbance of the month in the West Indies advanced from the vicinity of Barbados to the Yucatan Channel from the 2d to the 7th. [It is believed that this is the storm which reached the Texas coast by the morning of the 9th, where it caused high winds and high tides, as noted in the Galveston Forecast District report.—*E. B. G.*]

On the 2d the Barbados light-ship *Flummense* encountered a gale 60 miles north-northwest of Barbados. On the 4th severe storms were reported on the southern coast of Haiti. Ample warnings of the character and course of this disturbance were sent to points in its line of advance. Daily wind forecasts for the Atlantic and Gulf of Mexico north of Cuba and east and west of Florida were telephoned the captain of the port.—*W. B. Stockman, Forecast Official.*

RIVERS AND FLOODS.

The Mississippi River below the mouth of the Missouri was somewhat higher than during June, and considerably higher than during July, 1900. Below the mouth of the Missouri it averaged from 3 to 7 feet lower, the loss below Cairo, Ill., being directly attributable to the rapid decline in the Ohio, which was decidedly lower than during June. The stages, however, were not sufficiently low to interfere with navigation, and did not materially differ from those of July, 1900.

The Missouri fell steadily throughout the month, though not to any great extent.

The rivers of the East presented nothing of special interest, except in the Carolinas where heavy rains from the 12th to the 20th, inclusive, caused rapid rises to near or slightly above the danger lines at many places. Timely warnings were issued wherever necessary, and no serious damage was reported.

On the 27th of the month the Arkansas River at Little Rock, Ark., fell to a stage of 1.1 feet, one foot lower than during any previous July, the record extending back to 1872, and was still lower at other places within the State.

The Brazos River was also lower, and there was a steady fall in the rivers of the Pacific coast system.

The highest and lowest water, mean stage, and monthly range at 135 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport on the Red.—*H. C. Frankenfield, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	6, a.m.	41	101	9, p.m.	38	75	2,455	3.5	701	29.2
II.....	9, p.m.	48	104	13, p.m.	33	65	2,500	4.0	625	25.0
III.....	17, a.m.	50	100	30, p.m.	39	74	1,920	3.5	548	22.8
IV.....	22, a.m.	50	97	24, a.m.	33	80	1,200	2.0	600	25.0
V.....	23, a.m.	53	122	28, p.m.	45	67	3,680	5.5	669	27.9
VI.....	29, a.m.	50	111	*2, a.m.	37	86	1,900	4.0	475	19.8
Sums.....							13,655	22.5	3,618	150.7
Mean of 6 paths.....							2,276		608	25.1
Mean of 22.5 days.....									607	25.3
Low areas.										
I.....	1, p.m.	41	118	8, a.m.	46	60	4,150	6.5	638	26.6
II.....	5, a.m.	20	77	10, a.m.	29	95	1,200	5.0	240	10.0
III.....	6, a.m.	54	114	9, a.m.	45	98	1,800	3.0	600	25.0
IV.....	8, a.m.	22	70	10, a.m.	35	75	1,050	2.0	525	21.9
V.....	18, p.m.	50	110	23, a.m.	42	54	3,000	4.5	667	27.8
VI.....	24, a.m.	44	70	26, a.m.	35	75	700	2.0	350	14.6
VII.....	27, p.m.	39	108	31, a.m.	48	68	2,400	3.5	686	26.6
Sums.....							14,800	26.5	3,706	154.5
Mean of 7 paths.....							2,043		529	22.1
Mean of 26.5 days.....									540	22.5

* August.

For graphic presentation of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk Forecast Division.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following summaries relating to the general weather and crop conditions are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau.

[Temperature is expressed in degrees Fahrenheit and precipitation in inches and hundredths.]

Alabama.—The mean temperature was 82.2°, or 2.1° above normal; the highest was 108°, at Bermuda on the 12th, and the lowest, 56°, at Maple Grove on the 9th and at Riverton on the 10th. The average precipitation was 3.40, or 1.54 below normal; the greatest monthly amount, 8.95, occurred at Mobile, and the least, 0.35, at Notasulga.

The month, as a whole, was generally unfavorable for growth of all crops, except cotton, which made satisfactory progress. Prolonged drought in some northern, north-central, and south-central counties, together with excessively hot, parching winds during middle of month seriously damaged corn and gardens. Rainfall somewhat excessive in extreme southern and extreme northeastern counties.—*F. P. Chaffee.*

Arizona.—The mean temperature was 85.5°, or 2.8° above normal; the highest was 123°, at Mohawk Summit on the 9th and at Maricopa on the 10th, and the lowest, 31°, at Fort Defiance on the 7th. The average precipitation was 2.04, or 0.64 above normal; the greatest

monthly amount, 6.40, occurred at Pantano, and the least, trace, at a number of stations.

Light and widely scattered showers, high drying winds, with lack of water supply for irrigation purposes, during the first and second decades of the month seriously retarded plant growth, and farming operations were confined mostly to harvesting. A damaging frost occurred in the northeast section of the territory on the 7th, Fort Defiance reporting a minimum temperature of 31°. From the 20th to 31st general and beneficial rains occurred in all parts of the Territory, and the month closed with ranges greatly revived and irrigating canals running full.—*L. M. Dey, Jr.*

Arkansas.—The mean temperature was 83.7°, or 3.5° above normal; the highest was 116, at Jonesboro on the 12th, and the lowest, 50°, at Pond on the 10th. The average precipitation was 2.50, or 1.35 below normal; the greatest monthly amount, 7.55, occurred at Hot Springs (near), and the least, 0.10, at Arkansas City.

Showers fell in many sections, but were so light and scattered that very little benefit was derived. The temperature was excessively high during the greater portion of the month, and corn suffered greatly from the hot, dry weather; the first planted began to twist early in the month and the late planted was not doing well. Toward and during the last weeks of the month early planted corn had been so badly in-

jured that it was almost a total failure, while the late planted had been irreparably injured in some sections. Cotton stood the droughty conditions and heat fairly well during the early part of the month, but toward the close it had commenced to show the effects of the dry, hot weather; it had stopped growing, and had commenced to bloom on top and to shed its leaves and squares in many localities. Wheat thrashing had been completed and the yield was small, though better than had been anticipated. Harvesting of oats had been completed and by the end of the month thrashing was over; the yield was poor. Irish potatoes were rotting in the ground. Fruits of all kinds were scarce and had been damaged by the hot, dry weather.—*H. B. Richards.*

California.—The mean temperature was 76.0°, or 0.4° below normal; the highest was 121°, at Volcano on the 6th, 8th, 9th, 12th, 18th, and 19th, and the lowest, 28°, at Bodie on the 3d. The average precipitation was 0.01, or 0.04 below normal; the greatest monthly amount, 0.39, occurred at Bodie, while none fell at more than half of the stations.

Conditions during the month were generally very favorable for all crops. The usual high temperatures prevailed in the interior, causing rapid maturing of the fruit and grain crops, and along the coast the weather was warm and pleasant, with frequent fogs. Fires in the San Joaquin and Sacramento valleys destroyed many large fields of grain and pasturage. The month was practically free from northers.—*Alexander G. McAdie.*

Colorado.—The mean temperature was 71.6°, or 3.8° above normal; the highest was 108°, at Lamar on the 10th, and the lowest, 27°, at Wagon Wheel Gap on the 4th and Lay on the 5th. The average precipitation was 1.10, or 1.10 below normal; the greatest monthly amount, 3.71, occurred at Clear View, while none fell at Las Animas and only a trace at Fort Morgan.

Month was notably dry, with an exceptionally large number of hot days. Where water was available for irrigation, a majority of the crops made satisfactory progress. Excessive heat at a critical period caused a shrinkage in the yield of spring wheat, oats, and barley. Lack of moisture materially reduced yield of second cutting of alfalfa. At the beginning of the month water supply was generally adequate, but the volume diminished rapidly, and before its close late ditches were dry.—*F. H. Brandenburg.*

Cuba.—The mean temperature was 80.9°; the highest was 100°, at Nuevitas, Puerto Principe Province, on the 19th, and the lowest, 60°, at Los Canos, Santiago de Cuba Province, on the 25th. The average precipitation was 8.04; the greatest monthly amount, 13.97, occurred at Yaguajay, Santa Clara Province, and the least, 2.76, at Los Canos, Santiago de Cuba Province.

Seasonal rains occurred during the month, generally greatly benefiting growing crops, but interrupting or suspending field work, which, however, progressed at the end of the month in all sections, except in southeast Havana, on the lowlands of western Santa Clara, and in northeast Puerto Principe, where the soil was too wet to work. Rain was needed at the end of the month in southeast Santa Clara. Tobacco selecting progressed, except in northeast Pinar del Rio, where it was at a standstill. Canes generally were in a satisfactory to excellent condition. In southwest Santa Clara ratoons were beginning to show the ill effects of excessive moisture. Small crops were scarce in portions of southwest and northeast Pinar del Rio, southern Havana, north west Matanzas, and northern Santa Clara.—*W. B. Stockman.*

Florida.—The mean temperature was 81.8°, or 0.3° above normal; the highest was 107°, at Wausau on the 12th, and the lowest, 64°, at Sumner on the 6th. The average precipitation was 6.67, or about normal; the greatest monthly amount, 13.35, occurred at Earnestville, and the least, 1.55, at Merritts Island.

The condition of cotton was not entirely satisfactory during the early part of the month. It was from two to three weeks late, fruited slowly and troubled somewhat with rust. The staple improved during the latter part of the month, and the early planted was opening on uplands. Grass caused some trouble in eastern counties. Corn, as a rule, did well; the crop ranges from fair to excellent. Cane, citrus fruits, and minor crops were quite satisfactory.—*A. J. Mitchell.*

Georgia.—The mean temperature was 81.5°, or 1.8° above normal; the highest was 106°, at Thomasville on the 12th, and the lowest, 53°, at Ramsey on the 9th. The average precipitation was 4.18, or 1.76 below normal; the greatest monthly amount, 13.56, occurred at Waverly, and the least, 0.88, at Woodbury.

The warmest July in the past ten years. The 11th and 12th were generally the warmest days. The precipitation was a variable element, portions of the State suffering from drought, while in others, particularly the southeastern counties, the rainfall was excessive, ranging from 8 to 13 inches. The general effect of the weather on crops was favorable, and a marked improvement was noted at the close of the month.—*J. B. Marbury.*

Idaho.—The mean temperature was 69.7°, or 1.7° above normal; the highest was 113°, at Garnet on the 6th and 30th, and the lowest, 18°, at Chesterfield on the 5th. The average precipitation was 0.28, or 0.17 below normal; the greatest monthly amount, 2.17, occurred at Priest River, while none fell at American Falls, Downey, Garnet, Idaho City, Ola, and Payette.

There has been no appreciable precipitation in southwestern Idaho since the 30th of May, but water for irrigation is sufficient in this sec-

tion. In southeastern Idaho, where drought has been broken occasionally, there is great scarcity of water. There were no severe storms during the month.—*S. M. Blandford.*

Illinois.—The mean temperature was 82.3°, or 6.0° above normal; the highest was 115°, at Centralia on the 22d, and the lowest, 40°, at Chenuing on the 8th. The average precipitation was 2.44, or 1.04 below normal; the greatest monthly amount, 8.98, occurred at Dixon, and the least, trace, at Danville.

Very hot, and in many localities very dry, weather during July caused serious damage to vegetation generally. Except in northern district, the corn crop will be very light. Pastures are badly dried up and much stock must be fed.—*M. E. Blystone.*

Indiana.—The mean temperature was 81.2°, or 5.2° above normal; the highest was 112°, at Salem on the 22d, and the lowest, 46°, at Cambridge on the 9th. The average precipitation was 1.30, or 2.08 below normal; the greatest monthly amount, 5.95, occurred at Angola, and the least, traces, at Greencastle and Scottsburg.

The heat during the month was unprecedented. The maximum temperatures rose to 90° and above on an average of twenty-five days; the temperature equaled or exceeded 100° on an average of five days; in the southwestern part of the State the maximum temperatures ranged from 100° to 112° on an average of fourteen days. The promising condition of all late crops was materially reduced by the intense heat and continued absence of rain as the month advanced. Early planted and upland corn, and that portion of the crop planted in clay and sandy soils, was practically beyond recovery as a result of the drought, and the late planted and lowland crops were badly in need of rain to assure the average yield. Wheat, rye, oats, and barley, had generally reached maturity before the effects of the drought were severely felt. Tobacco was badly needing rain, and tomatoes, potatoes, and gardens, were in poor condition. Much fruit was wilting on the trees, and apples continued falling; peaches were plentiful. A good hay crop was secured, but timothy was weedy.—*R. H. Sullivan.*

Iowa.—The mean temperature was 82.4°, or 8.7° above normal; the highest was 113°, at Sigourney on the 22d, and the lowest, 46°, at Maquoketa on the 8th. The average precipitation was 2.34, or 1.34 below normal; the greatest monthly amount, 5.97, occurred at Ridgeway, and the least, 0.22, at Denison.

July, 1901, broke all previous records in this State of maximum temperatures and great length of the period of extreme heat. The effect on crops and all forms of vegetation was very injurious, and the damage would have been greater than in the notable drought of 1894, but for the fact that the soil was generally better supplied with moisture at the outset, and the rainfall was much nearer the normal amount. Corn, pastures, potatoes, garden truck, and apples, suffered most heavily. The conditions were favorable for securing hay, wheat, oats, barley, and rye in fine order.—*John R. Sage.*

Kansas.—The mean temperature was 85.0°, or 7.0° above normal; the highest was 112°, at Phillipsburg on the 16th, and the lowest, 44°, at Coolidge on the 31st. The average precipitation was 1.94, or 2.16 below normal; the greatest monthly amount, 4.85, occurred at Rome, and the least, 0.15, at Abilene and Achilles.

Hot, dry month, highest mean for any month on State records; drought broken in eastern counties last week; early corn ruined, late held well but damaged some; pastures failed; hay crop light; gardens died; stock water scarce; fruits failing. In eastern counties, last week, pastures and meadows started anew, and late corn, peaches, and winter apples, began improving.—*T. B. Jennings.*

Kentucky.—The mean temperature was 81.7°, or 4.0° above normal; the highest was 112°, at Paducah on the 23d, and the lowest, 48°, at Centertown and Fords Ferry on the 8th and at Loretto on the 9th. The average precipitation was 1.72, or 2.67 below normal; the greatest monthly amount, 4.32, occurred at Williamsburg, and the least, 0.17, at Bowling Green.

Very warm weather prevailed throughout the month, the last decade being intensely hot. All previous records for heat were broken. Very little rain fell in the State from the 5th to 29th, and a severe drought resulted. Early corn and gardens were ruined, and all other crops suffered severely.—*H. B. Hersey.*

Louisiana.—The mean temperature was 83.0°, or 1.2° above normal; the highest was 111°, at Liberty Hill and Minden on the 13th, and the lowest, 55°, at Plain Dealing on the 9th. The average precipitation was 5.07, or 1.61 above normal; the greatest monthly amount, 15.83, occurred at Amite, and the least, 2.07, at Prevost.

During the first three weeks beneficial showers occurred in south portion, elsewhere rainfall was deficient; last week of month copious showers occurred generally throughout the State, improving all crops. Excessive heat prevailed throughout Louisiana from 12th to 18th; on the 13th and 14th maximum temperatures ranging from 98° to 111° obtained all over the State, breaking all previous records; latter part of month comparatively cool. Cane crop made good progress, some laid by in fine condition, and at close of month showed good color, had attained normal size, and looked promising. Cotton crop did fairly well, and in northern counties stood the drought better than expected; at close of month the stands were small, condition somewhat improved, and growing and fruiting well; some picking was done in southwest portion of cotton district. Rice, wherever irrigated, will

make a fine crop, and in some favored localities Providence rice was saved by timely showers. Old corn practically a failure; young corn will make a light crop.—*I. M. Cline.*

Maryland and Delaware.—The mean temperature was 78.8°, or 3.1° above normal; the highest was 106°, at Hancock, Md., on the 1st, and the lowest, 40°, at Sunnyside, Md., on the 7th. The average precipitation was 5.42, or 1.32 above normal; the greatest monthly amount, 10.81, occurred at Wyoming, Del., and the least, 2.11, at Westernport, Md.

The intense heat early in July caused many prostrations and deaths, but cooler weather on the 8th brought relief, and since then the hot spells have been endurable. The rainfall was ample, and in places excessive, except in the northeastern, southeastern, and extreme western districts, where the amounts were comparatively light. The general weather conditions of the month were favorable to growing crops, but frequent and heavy showers during the harvest period damaged wheat, rye, oats, and hay. These crops are below average in yield for the State, although good local returns are reported for all except oats, which are everywhere poor. Tobacco was hurt to some extent by heat and heavy rains, but improved later. Peaches are in fair promise, but other fruits will yield lightly. Early potatoes are not coming up to expectations, but late potatoes are more promising. Tomatoes have not fruited well in most districts. Gardens and other minor crops have fared satisfactorily.—*Oliver L. Fassig.*

Michigan.—The mean temperature was 72.8°, or 4.3° above normal; the highest was 108°, at Marquette on the 15th, and the lowest, 29°, at Humboldt on the 7th. The average precipitation was 4.20, or 1.22 above normal; the greatest monthly amount, 10.40, occurred at Iron River, and the least, 1.32, at Fennville.

The month has been characterized by high temperatures, and in many counties by heavy rainfall. Most crops have made good growth and hay, wheat, and rye were generally well secured. Hot and dry weather prevailed during the second decade, greatly shortening the berry and early potato crops. Corn, sugar beets, beans, and late potatoes have made fine progress during the month and are in a very promising condition. In the extreme southwestern portion of the Lower Peninsula the conditions have been droughty all the month, but the area is small. The conditions were unfavorable for oats, which matured on a short straw and were mostly harvested by close of month.—*C. F. Schneider.*

Minnesota.—The mean temperature was 74.7°, or 4.0° above normal; the highest was 110°, at New London on the 20th and 24th, and the lowest, 35°, at Tower on the 8th. The average precipitation was 3.33, or 0.29 below normal; the greatest monthly amount, 12.08, occurred at New Folden, and the least, 0.81, at Lynd, No. 2.

There was showery weather the first week of the month, and from the 24th to about the 28th. A period of excessively high temperatures lasted from the 13th to the 24th, with several mid-day temperatures higher than ever previously recorded in the State. The month opened with all the crops in an unusually promising condition, except those which were flooded on the lowlands of the Red River Valley early in the month, but the intense heat of the middle of the month brought on premature ripening of wheat and early oats in southern and central portions, with serious loss to yield and quality of wheat. In the northern counties the wheat does not seem to have been injured by the heat. The corn was benefited by the moisture and heat early in the heated term, but as the soil moisture was lost, corn deteriorated, so that by the end of the month the prospects for a good crop were much lessened. Rye, early barley, and winter wheat were being cut the first week in the month; early oat cutting began shortly before the 15th, and spring wheat on the 16th. A large hay crop was being saved in northern, central, and southwestern portions.—*T. S. Outram.*

Mississippi.—The mean temperature was 83.3°, or 2.2° above normal; the highest was 110°, at Windham on the 12th, and the lowest, 52°, at Aberdeen on the 7th. The average precipitation was 3.98, or 1.35 below normal; the greatest monthly amount, 11.43, occurred at Biloxi, and the least, 0.25, at Hernando.

The mean temperature for the month was the highest on record. The maximum temperature reached 100° or more at every station. Over the northern and middle portions of the State the average deficiency in rainfall was more than 2.00 inches, while over the southern portion the excess on the average exceeded 2.00 inches. Early corn was practically ruined by the dry weather of June and the first half of July; as a rule, late corn promised a fair crop. Cotton, although late and small, generally did well; at the close of the month it was growing rapidly and fruiting satisfactorily, except in the northern portion of the State, where its growth was retarded by blooming to the top. Owing to the drought in many northern and central counties minor crops were poor, pastures dry, and stock water scarce, while in the southern counties rice, sugar cane, sweet potatoes, and melons generally did well.—*W. S. Belden.*

Missouri.—The mean temperature was 85.3°, or 8.4° above normal; the highest was 116°, at Marble Hill on the 22d, and the lowest, 46°, at Potosi on the 8th. The average precipitation was 2.03, or 2.46 below normal, the greatest monthly amount, 4.90, occurred at Shelby, and the least, 0.05, at Mt. Vernon.

July, 1901, broke all records of high temperature in this State. The

period of extreme heat began on June 20 and continued almost uninterruptedly until July 25, thirty-six days. The temperature was above 100° in some portion of the State every day from June 20 to July 31, and on July 12, 22, and 23 it reached 100° or above at all stations, maximum temperatures of 110° and above being recorded at many stations. At nearly all stations the mean temperature of July was from 3° to 9° higher than any July mean previously recorded. The drought, which began April 18, 1901, continued throughout the greater part of the State until July 25, and was greatly intensified by the extremely high temperature. Corn, which had already been damaged to a considerable extent at the beginning of the month, continued to deteriorate until at the close the larger portion was entirely beyond recovery and, on an average, hardly one-fourth of a crop was expected. Cotton also declined considerably and there was much complaint of shedding. The oat crop was one of the poorest ever harvested in the State, and flax was almost a complete failure. The hay crop was secured in good condition, but was extremely light. Pastures continue dry and short, and water became very scarce in many places. Apples and peaches were greatly damaged and gardens were almost completely dried up.—*A. B. Hackett.*

Montana.—The mean temperature was 69.1°, or 2.4° above normal; the highest was 112°, at Billings on the 31st, and the lowest, 28°, at Ovando on the 4th. The average precipitation was 1.02, or 0.14 below normal; the greatest monthly amount, 3.65, occurred at Glendive, while none fell at Corvallis.

The mean temperature for the month was above the normal over the east portion; in the central portion the record for the highest monthly mean temperature was broken at almost every station, and it was the coldest on record over the extreme northwest portion of the State. The stage of water in all streams is extremely low and in many localities there is not a sufficient supply for irrigation purposes.—*E. J. Glass.*

Nebraska.—The mean temperature was 82.0°, or 7.0° above normal; the highest was 111°, at Dawson on the 22d, and the lowest, 45°, at Camp Clark on the 5th. The average precipitation was 1.59, or 1.78 below normal; the greatest monthly amount, 7.19, occurred at Fairmont, while none fell at Wallace.

The excessively high temperature which prevailed from the 8th to the 27th, combined with the great deficiency in precipitation, was exceedingly unfavorable for all vegetation. Winter wheat ripened before the drought and was harvested in good condition. Berries and garden vegetables dried up almost completely. Oats and spring wheat were much damaged, but corn suffered the most seriously, being in the critical period of growth, the tassels were largely killed and the crop reduced to a small fraction of what it should have been.—*G. A. Loveland.*

Nevada.—The mean temperature was 70.8°, or about normal; the highest was 109°, at Halleck on the 30th, and the lowest, 31°, at Quinn River Ranch on the 1st. The average precipitation was 0.31, or 0.10 below normal; the greatest monthly amount, 1.19, occurred at Palmetto, while none fell at several stations.

The early part of the month was moderately cool, but the latter portion was very much warmer than usual. The precipitation was remarkably light all over the agricultural portion of the State. Irrigation water was plentiful, and all crops made rapid and satisfactory growth. Favorable weather prevailed for harvesting hay and grain.—*J. H. Smith.*

New England.—The mean temperature was 71.4°, or 2.6° above normal; the highest was 104°, at Provincetown, Mass., on the 4th, and the lowest, 36°, at Flagstaff, Me., on the 24th and 25th. The average precipitation was 4.24, or 0.43 below normal; the greatest monthly amount, 6.79, occurred at Plymouth, N. H., and the least, 0.91, at Eastport, Me.

The weather of the month was warm with well distributed showers, and the general conditions were favorable to crops and to farm operations. No general storm passed over the section, although thunderstorms were of frequent occurrence, which in a number of instances were destructive to property.—*J. W. Smith.*

New Jersey.—The mean temperature was 73.3°, or 3.3° above normal; the highest was 107°, at Somerville, Indian Mills, and Salem on the 2d, and the lowest, 41°, at Layton on the 20th. The average precipitation was 5.87, or 0.91 above normal; the greatest monthly amount, 10.92, occurred at Dover, and the least, 1.89, at Atlantic City.

A very warm, sultry month, with frequent, and in places, severe thunderstorms, doing considerable injury to the growing crops. Wheat, rye, and hay harvested. Hay all housed in fine order, but wheat and rye damaged by excessive rains. All truck crops promising, except potatoes and late tomatoes. Tree fruits, except peaches, will be a very short crop; grapes promising.—*E. W. McGann.*

New Mexico.—The mean temperature was 75.1°, or 1.1° above normal; the highest was 110°, at San Marcial on the 5th and 6th, and the lowest, 40°, at Blue Water on the 5th. The average precipitation was 2.75, or 0.22 below normal; the greatest monthly amount, 6.68, occurred at Lower Penasco, and the least, trace, at Olio.

All crops made satisfactory growth. Feed and water continued sufficient on stock ranges, and cattle and sheep were in very good condition.—*R. M. Hardinge.*

New York.—The mean temperature was 73.0°, or 4.1° above normal; the highest was 104°, at Primrose on the 2d, and the lowest, 34°, at Axton on the 26th. The average precipitation was 4.28, or 0.09 above

normal; the greatest monthly amount, 9.63, occurred at Primrose, and the least, 1.79, at Lyons.

The month was generally favorable for the harvest and for the growth of crops. The first few days were intensely hot, and high temperatures obtained during the week ending on the 22d, but on other dates more moderate temperatures were reported. While there were several short periods, during which the ground was too dry for favorable crop growth, the precipitation for July was generally sufficient to insure satisfactory crop conditions at the close of month.—*R. G. Allen.*

North Carolina.—The mean temperature was 78.8°, or 1.3° above normal; the highest was 105°, at Washington on the 25th, and the lowest, 49°, at Linville on the 10th. The average precipitation was 6.59, or 0.98 above normal; the greatest monthly amount, 13.23, occurred at Southern Pines, and the least, 1.23, at Murphy.

Considerable improvement in crops took place during the early and latter portions of the month in consequence of dry, warm weather, but the excessive precipitation from the 8th to the 20th was extremely injurious, causing rank growth, trouble with grass and weeds, damage to land by washing, and destruction of lowland crops by freshets. Fruit of all kinds rotted badly.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 70.8°, or 2.8° above normal; the highest was 110°, at Fort Yates on the 24th, and the lowest, 40°, at Ashley on the 28th. The average precipitation was 4.28, or 1.65 above normal; the greatest monthly amount, 8.14, occurred at Power, and the least, 1.13, at Fort Yates.

The mean temperature was higher than the average, with a few very warm days, when the highest maximum temperatures ever recorded were observed. While the total precipitation was considerably in excess of the normal amount, on the whole, the month was very favorable for crops of all kinds, and they made a very marked and vigorous growth.—*B. H. Bronson.*

Ohio.—The mean temperature was 78.1°, or 4.4° above normal; the highest was 109°, at Camp Dennison and Jacksonboro, on the 22d, and the lowest, 48°, at Lima and Orangeville on the 9th. The average precipitation was 2.73, or 1.25 below normal; the greatest monthly amount, 6.62, occurred at Plattsburg, and the least, 0.55, at Jacksonboro.

High temperatures prevailed during the greater part of the month, the mean for the State being the highest ever recorded. After the first week, in the southern and western districts, a drought set in which continued through the month, being most severe in the south. All crops and fruits have been seriously affected, excepting corn in the northern districts.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The mean temperature was 85.9°, or 4.4° above normal; the highest was 116°, at Wagoner, Ind. T., on the 16th, and the lowest, 42°, at Kenton, Okla., on the 5th. The average precipitation was 1.92, or 1.58 below normal; the greatest monthly amount, 5.78, occurred at Holdenville, Ind. T., and the least, 0.02, at Oklahoma, Okla.

Intense heat, with an almost entire lack of precipitation during the forepart, and with light to heavy local showers during the latter part, characterized the month. Early corn was almost entirely ruined, while late corn was badly injured. Cotton, kaffir and broom corn, cane, and castor beans were in fair condition, but gardens and fruit were badly damaged. Pastures were revived by recent rains, stock water was scarce, and stock suffered for lack of water and feed. Wheat thrashing nearing completion.—*Charles M. Strong.*

Oregon.—The mean temperature was 64.8°, or 1.6° below normal; the highest was 108°, at Riverside on the 6th, and the lowest, 28°, at Beulah on the 4th. The average precipitation was 0.19, or 0.26 below normal; the greatest monthly amount, 2.68, occurred at Bay City, while none fell at several stations in eastern and southern portions.

The month was favorable for the ripening of grain and fruit. The harvesting of fall grain was inactive progress at the close of the month. Haying was finished during the third week, and a large crop was housed in excellent condition.—*Edward A. Beals.*

Pennsylvania.—The mean temperature was 76.4°, or 4.9° above normal; the highest was 107°, at York on the 2d, and the lowest, 45°, at Emporium on the 7th. The average precipitation was 3.88, or 0.59 below normal; the greatest monthly amount, 7.34, occurred at Forks of Neshaminy, and the least, 1.52, at Harrisburg.

The first week was extremely hot throughout the State; on the 1st and 2d the temperature at many points reached an unprecedented height. From the 8th to 15th cooler and more seasonable weather prevailed, with frequent showers throughout all the State. The remainder of the month continued warm until the 26th, when a very perceptible fall in temperature occurred and the remainder of the week was cool, the mean temperatures being very generally below normal. With the exception of the 19th, 20th, and 21st rain fell on every day the balance of the month. At the close of the month rye cutting continued where showers did not interfere, and the consensus of opinion is that the yield will be generally good. Wheat, in many cases, is not turning out well; some thrashing has been done and a great deal of the crop has been found to be light in yield and the grain of an inferior quality. Haying continues, the crop still proving above an average one. Buckwheat looks well; more will be sown on a large number of farms as soon as the weather becomes favorable. Tobacco made considerable improvement and is very generally overcoming its

late and unfavorable start. Corn made rapid growth and some is now silking and tasseling. The potato crop, as a whole, is not in an encouraging condition, as the bugs are very numerous and the tubers are not developing satisfactorily. Apple crop still poor; other fruits doing well. Truck looks promising.—*T. F. Townsend.*

Porto Rico.—The mean temperature was 79.0°, or about normal; the highest was 96°, at Coamo and the lowest, 58°, at Ponce. The average precipitation was 12.73, or 5.53 above normal; the greatest monthly amount, 33.58, occurred at Hacienda Perla, and the least, 4.61 at Isabella.

Excessive rains have occurred in the northeastern and southwestern parts of the island, elsewhere the weather has been about normal. The drought has been broken in Ponce and San German districts. In a few localities ground provisions have been injured by continued rains. Coffee is maturing and reports indicate an excellent crop both in quantity and quality. Grinding of cane has continued in some few localities. Much rice has been sown and is doing well. A good crop of corn is being harvested. New cane fields are growing nicely. Minor crops are abundant. Farm operations active.—*E. C. Thompson.*

South Carolina.—The mean temperature was 81.4°, or 1.9° above normal; the highest was 102°, at Batesburg and Longshore on the 25th, and the lowest, 62°, at Walhalla on the 19th. The average precipitation was 4.52, or 1.85 below normal; the greatest monthly amount, 13.25, occurred at Georgetown, and the least, 0.65, at Winnsboro.

Both the slight excess in temperature and the deficiency in precipitation were favorable conditions, and facilitated ridding field crops of grass and weeds that had attained a rank growth during the previous month, and gave opportunity to give crops much needed cultivation. Corn, cotton, and tobacco made great improvement, and the last-named crop was largely cut and cured. Minor crops did well.—*J. W. Bauer.*

South Dakota.—The mean temperature was 78.2°, or 6.0° above normal; the highest was 115°, at Ipswich on the 20th, and the lowest, 34°, at Rochford on the 5th. The average precipitation was 1.73, or 1.03 below normal; the greatest monthly amount, 3.69, occurred at Mound City, and the least, 0.48, at Canton.

The prominent meteorological features of the month were excessively high temperature on many days, unusually protracted periods of heat without relief, and unusually great deficiency in precipitation over much of the State. At Vermillion, Clay County, the temperature reached or exceeded 100° on sixteen days. Late and medium late spring wheat, oats, and late barley were to a considerable extent blighted and the grain shrunk by the excessive heat and premature ripening, and corn, millet, potatoes, flax, and pastures suffered materially from heat and drought. There was some local hail damage to crops at times through the month, and on the 28th some late wheat, oats, and barley remaining uncut were damaged by wind and hail in the northern counties. At the close of the month barley and spring rye harvest was completed, except in some northern counties; spring wheat harvest was completed in the southern counties and progressing rapidly elsewhere, and oat harvest was farther advanced than that of wheat.—*S. W. Glenn.*

Tennessee.—The mean temperature was 81.1°, or 3.1° above normal; the highest was 107°, at several stations on different dates, and the lowest, 45°, at Erasmus on the 9th. The average precipitation was 2.01, or 2.47 below normal; the greatest monthly amount, 7.14, occurred at Bristol, and the least, trace, at Springfield.

The month was characterized by severe drought and extremely high temperature, which proved disastrous to early corn over large portions of the middle and western sections; tobacco, cotton, potatoes, and fruit crops suffered greatly, and gardens were almost ruined. Thrashing of wheat and oats progressed favorably, with generally very good yields. The drought was broken about the 30th, with cooler weather, but not until many fields of early corn had been practically lost.—*H. O. Bate.*

Texas.—The mean temperature was 84.5°, or 1.3° above normal; the highest was 110°, at Haskell on the 19th, and the lowest, 57°, at Mount Blanco on the 10th. The average precipitation was 2.46, or 0.12 below normal; the greatest monthly amount, 9.99, occurred at Brazoria, while none was recorded at Camp Eagle Pass.

Favorable weather conditions prevailed for farm work during the first two weeks of the month, and wheat, oats, and hay were secured in good condition and without interruption; wheat yielded much less than the average crop, and oats, except in a few cases, was almost an entire failure. A fair crop of hay was made. The drought which prevailed over the greater portion of the State, with warm weather and dry southerly winds, ruined many promising fields of corn, destroyed gardens, and dried up some of the smaller water courses. Providence rice was mostly killed and the irrigated crop was badly damaged. Cotton suffered some, and in many sections of the southern portion was infested with boll weevil, but the crop as a whole, while backward, passed through all unfavorable conditions without serious injury. At the close of the month dry weather still prevailed over a large area in the central portion; elsewhere, throughout the State, the drought had either been partially or completely broken by light to heavy showers on the 25th and 26th. Where rain fell a rapid and marked improvement was noted in cotton, sugar cane, millet, sorghum, and late planted corn. Gardens were mostly too far gone to be benefited, and early corn, having for the most part matured prematurely, was practically

made. In the dry sections cotton, while holding its own remarkably well, was beginning to suffer for moisture; picking began in some of the southern counties about the 15th, and by the close of the month a number of bales had been ginned and marketed.—*N. R. Taylor.*

Utah.—The mean temperature was 75.4°, or 2.7° above normal; the highest was 115°, at Hite on the 10th, and the lowest, 27°, at Soldier Summit on the 4th. The average precipitation was 0.41, or 0.19 below normal; the greatest monthly amount, 1.76, occurred at Frisco, while none fell at Corinne and Kelton.

One of the warmest, if not the warmest, months since the settlement of the State.—*L. H. Murdoch.*

Virginia.—The mean temperature was 78.6°, or 1.3° above normal; the highest was 106°, at Stephens City on the 1st, and the lowest, 47°, at Burkes Garden on the 9th. The average precipitation was 4.94, or 0.42 above normal; the greatest monthly amount, 9.82, occurred at Alexandria, and the least, 2.44, at Callaville.

The month, as a whole, was quite favorable for crop growth and work. Extremely high temperatures prevailed during the first and last days of the month, but no crop damage resulted. There were also a number of heavy, washing rains and some fresher water in small streams. These were productive of some harm to lowland corn and tobacco, but not sufficient to materially affect the general situation.—*Edward A. Evans.*

Washington.—The mean temperature was 62.8°, or 2.5° below normal; the highest was 106°, at Pasco on the 30th, and the lowest, 30°, at Snoqualmie Falls on the 12th. The average precipitation was 0.57, or 0.07 below normal; the greatest monthly amount, 2.48, occurred at Ilwaco, while none fell at Ellensburg, Lakeside, and Pasco.

Although rather cool for corn and several kinds of vegetables, the month was the best possible for the heading out and filling of spring wheat. It was also very favorable for haying, and ideal for fall wheat harvesting.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 77.4°, or 3.7° above nor-

mal; the highest was 104°, at Magnolia and New Martinsville on the 1st, and the lowest, 47°, at Philippi on the 9th. The average precipitation was 3.16, or 1.63 below normal; the greatest monthly amount, 6.21, occurred at Josiah, and the least, 0.69, at Parkersburg.

Fine harvest weather during the month; wheat cutting completed by the fourth week, and wheat mostly in stack and thrashing begun, but yield not meeting expectations, there not being more than half to two-thirds crop. Clover and rye cutting mostly over by second week, with fair yields. During the third week grass and oat cutting in general progress, and by the last of the month, these crops had been mostly saved in fine condition, with a good crop of hay and a fair yield of oats. Crops of all kinds continued to improve until the fourth week, when the intense heat and drought began to have an injurious effect, especially on corn, gardens, and potatoes. Apples continued to fall, and the prospect was for not more than half a crop; peaches plentiful, but small and of inferior quality.—*E. C. Voss.*

Wisconsin.—The mean temperature was 75.3°, or 5.8° above normal; the highest was 111°, at Brodhead on the 21st, and the lowest, 33°, at City Point on the 7th. The average precipitation was 4.29, or 2.23 above normal; the greatest monthly amount, 9.17, occurred at Florence, and the least, 0.86, at Racine.

The month was characterized by a severe and protracted drought over the southern section of the State, which, together with the excessive heat, caused much damage to corn, tobacco, and other crops. In the central and northern portions the rainfall was ample, and in some localities excessive. In the central and northern sections a large hay crop was secured in excellent condition, and other crops are satisfactory.—*W. M. Wilson.*

Wyoming.—The mean temperature was 71.3°, or 4.4° above normal; the highest was 110°, at Fort Bitter Creek on the 14th and 16th, and the lowest, 23°, at Daniel on the 5th. The average precipitation was 0.70, or 0.39 below normal; the greatest monthly amount, 2.87, occurred at Casper, while none fell at Embar and Hyattville, and but a trace at Lander and Fort Washakie.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

THE THUNDERSTORM; A NEW EXPLANATION OF ONE OF ITS PHENOMENA.

By BYRON MCFARLAND, A. B., dated Monroe City, Mo., June 17, 1901.

The daily weather maps issued by the United States Weather Bureau show that areas of high pressure, and areas of low pressure—or highs and lows—are continually passing across the continent in a more or less easterly direction. Thunderstorms occur usually in these lows and are therefore called secondary storms, being small, local storms in a large, or general, storm area. These storms furnish the chief supply of rain during the summer months. There can be little doubt but that thunderstorms are composed of rising air and descending air; the air currents blow both *to* and *from* the thunderstorm—both *up* and *down* in it. A peculiar feature of the thunderstorm is the coolness of the air within it. At the storm's arrival the temperature may drop from 10° to 30° F., or even more.

Some of the facts known about thunderstorms are as follows: (a) from some distance in front the air blows toward the storm, turns upward as it approaches it, and finally enters the main cloud. (b) On the ground below the margin of the cloud the air blows from the cloud; this forms the "squall" or strong cool wind that usually precedes the main storm proper. (c) In the center of the storm, the air is more nearly calm than at the border—especially its front border. (d) The air pressure is greater in the center of the storm than just in front of the margin of the cloud, i. e., the barometer rises slightly, and generally suddenly, during the passage of the cloud. (e) The air in the "squall" is considerably cooler than the surrounding air.

To account for these phenomena of pressure and of air currents (a-e) three explanations have been offered: (1) The rain drops falling through the air, push it down and out, thus producing the rise of the barometer and the "squall" below. (2) The warm moist air rising into a region of decreased air pressure, becomes cloud and expands, and in thus pushing

aside the surrounding upper air it presses downward with more than its weight, causing at once the slight rise in the barometer at the ground and the outrushing squall. The ascending air produces therefore a sort of recoil comparable to the "kick" of a gun, and this recoil is what "kicks" out the squall below. (3) The rising air above overflows into the neighboring air, and this additional weight produces the increased pressure and the squall below.

(1) The first of these explanations has undoubtedly some foundation in fact, for falling bodies will produce descending currents and lateral winds below. But the fact that the intensity of the squall is not always proportional to the intensity of the rainfall shows that the theory is only a partial explanation of the phenomena in question. (2) The second-named theory is even less tenable. That cloudy air in ascending cools more slowly, and hence expands more rapidly than dry air, is quite true; but this expanding air can not "kick" a constant squall out of the bottom. I will admit that should a large mass of warm, cloudy air be in some way carried up to the center of the convectional column and there suddenly turned loose, it would expand and increase temporarily the pressure down at the ground. But the thunderstorm is a continuous process of some duration. The following statements appear to me as being in this connection unquestionably true, viz, (1) the pressure at the ground could not be increased without the pressure above being also and even first increased; (2) the increased pressure at the ground could not be maintained (as it in fact is) unless the increased pressure above be maintained; and (3) if the increased pressure above be maintained, convection would cease, and the thunderstorm would be brought at once to an end.

In my judgment, the only condition under which air can continue to rise for hours into the upper part of the storm is the presence there, not of increased, but of relatively decreased air pressure. The idea that the rising and expanding air above can maintain a constant downward recoil or "kick" sufficient